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ON p. 237 of our number for July 28, we had occasion, in speaking of the efforts which had been made at home and abroad for ameliorating the condition of the poor by improving their dwellings, to refer to the remarkable progress made by our fellow-citizens of Philadelphia in this direction. Their experience in this respect is in the highest degree instructive and interesting, not only to political economists, who are aiming to convert the irresponsible populace into thrifty citizens, having an interest of property in the commonweal, but to architects, who will find that their own natural function in the realization of this important object has not hitherto been exercised as it should be. We learn from statistics collected by the Hon. Lorin Blodget, in an article in the April number of the *Penn Monthly*, entitled, "A Building System for the Great Cities," that since the year 1867 an annual average of 4,500 houses, or independent homes, of brick or stone, costing from $1,200 to $3,800 each, with a rental of from $11 to $25 per month, have been erected in the city of Philadelphia; and not more than 70 yearly of larger size. Of these, already from one-half to three-quarters are entirely owned by their occupants. A glance at our Building Intelligence of this week will show that this activity is still maintained. In New York the annual increase of dwellings of all classes is not over 500. The Philadelphia system, although frontage is not allowed upon any street narrower than thirty feet, gives in the districts occupied by houses of this cheaper class, a population of 78,000 to the square mile. This rather exceeds the average density of population in the large cities; so that the natural inference that districts of these small houses would become inconveniently large, and distribute the inhabitants too sparsely, does not seem to be justified. It is stated that some sixty thousand working-men with their families have thus been supplied with independent homes. Mr. Blodget describes the standard forms of the single house in Philadelphia as follows: —

"The form of building under the single-house system is established with much uniformity — perhaps too entirely uniform, some may say; but the necessities of the case admit only the best, and it can scarcely be denied that the forms employed are wonderfully successful. There are three primary forms, as they may be called, described as the two-story four-roomed house, the two-story six-roomed, and the three-story eight-roomed. They are always of brick, erected on stone-walled cellars not less than seven feet deep, 14 x 28 feet for the smallest houses, 14 to 16 x 42 to 45 feet for the six-roomed houses, and the same for the three-story houses of eight rooms, which differ from the larger two-story houses only in having three stories on the front and two stories at the back. All these are built in contiguous rows or blocks, with a common wall between them. No external or dividing wall is less than twelve inches thick, with hard or pressed brick for the outside, and salmon or light absorbent brick for the inner facings. There is little criticism possible upon either the materials or the mode of building of these standard houses, which have taken the place of all others almost, and are limited by well-defined building laws, so that there is scarcely any opportunity for the substitution of inferior structures. In fact, there is no temptation to do so: the great number annually built, and the facility of access to unbuilt suburbs, would deprive the careless or lawless builder of all profitable use for poor houses."

IN further illustration of the character of these cheap houses, which in this extraordinary experience at Philadelphia have been found so acceptable to the occupants, and of such incalculable use in improving the condition of the working-classes, we present on another page two sketches by Mr. Davis E. Supplee, architect, of that city, which appeared in February, 1876, in *Scribner's Monthly*, illustrating an interesting article by Mr. Charles Barnard, entitled, "A Hundred Thousand Homes." Plan B indicates the "back building," so common in Philadelphia and Baltimore; and plan C shows the extension in front when the family has increased in size and means. These houses are built in pairs, with an eight-foot passage between. The elevations indicate two methods of treating the principal façades of the "back buildings." But as these houses are built according to a rigid standard, with the utmost economy consistent with sound workmanship, and by a contractor who pays for the land a ground rent secured by the building erected thereon, the districts so improved present to the æsthetic sense a desert of monopoly, with no touch of beauty or grace, no varying charm of expression, to attract the eye and refine the mind. Mr. Supplee's sketch is an effort to obviate this defect. It is evident that the problem offers opportunities of design, both within and without, which are well worth the study of the architect, and which, if properly availed of, would confer upon such undertakings a new interest, and give them, as it were, a new faculty to exercise in their great work of civilizing. To this work our columns are always open, and we shall gladly publish any good projects for houses of this class, which would contribute any new thought toward the increase of their convenience, economy, and beauty.

WE have received from the publisher a very admirable, practical hand-book,[1] by Edmund Wrigley of Philadelphia, on the management of what are known in Pennsylvania as "Building Associations." This work, we believe, is accepted as the standard authority on this subject. It may not be generally known in this neighborhood that these associations are not *necessarily* concerned with building, but are more properly mutual saving fund and loan societies, based purely upon co-operative principles, and "consisting of a partnership in the profits of money as a money-maker, *equitably distributed* in proportion to the *severalties of capital* furnished by the individual members thereof." These associations are, we believe, mostly used by the same class of persons as in New England make deposits in savings banks. Each association manages its own affairs, and elects its own officers under certain wholesome legislative restrictions. Its members engage each to make a periodical (weekly or monthly) payment of a small sum (fifty cents to two dollars) per share into the common treasury, the ultimate value of the share being fixed at two hundred dollars. The capital thus collected is loaned in parcels, at periodical auction sales, to members at six per cent interest; those bidding the highest premium obtaining the loan. The amount of the premium is deducted from the amount loaned, and added to the loan-fund. The money earned by the association in interest, premiums, and fines, of course increases the value of the shares, which are generally used by the owners as collateral security for whatever money they may wish to borrow from the fund at the periodical sales. The facilities for borrowing offered by these associations are largely used by their members in the gradual process of purchasing their homes. This very safe, simple, and inexpensive system of co-operative banking is fostered by legislation in Pennsylvania and several of the Western States. Membership is apt to be limited naturally to neighborhoods and small communities. An admirable account of the practical working of the Building Associations is given by Mr. Charles Barnard as mentioned above; and the volume before us gives all the rules, examples, and explanations essential to a complete understanding of the subject. By the exertions of the Hon. Josiah Quincy of this city and others having in view the interests of the laboring

[1] How to Manage Building Associations; a Director's Guide and Secretary's Assistant, etc. By Edmund Wrigley. Second edition, enlarged. Philadelphia: James K. Simon, 29 South Sixth Street. 1876.

classes, a law was passed last year in the Massachusetts Legislature, authorizing the formation of "Loan and Fund Associations," after the manner of those which have been so numerous and successful in Pennsylvania. We are glad to learn that several organizations are now in process of formation under this act. Indeed, one of these associations had its first meeting and sale of loans on the evening of August 6, in Boston. At this meeting Mr. Quincy stated that there are four hundred and fifty organizations of this sort in the city of Philadelphia alone, and that there had not been an ultimate failure in one of them. He also announced that at least seventy millions of dollars had been invested in these associations, while there are but fourteen millions in all the savings banks of that city.

THE vestry of Trinity Church, Boston, has printed together with the sermon delivered by the Rev. Dr. Vinton at the consecration of that church, Feb. 9, 1877, an historical discourse by the rector, the Rev. Phillips Brooks; and a description of the building by Mr. H. H. Richardson, one of its architects. This description includes just such a narrative of the incidents of construction, just such a statement of the practical difficulties encountered, with the method of surmounting them, as should be prepared for the use of the public and of posterity in the case of every important building. Every such structure is intended to be in some respect an improvement on its predecessors. We generally can look for the marks of progress only among those features which are evident to the eye; but those which are concealed in the structure, and which are hardly less instructive and useful, are soon forgotten. We quote in another column from Mr. Richardson's narrative those passages relating to the foundations of the four piers of the central tower, which is fifty-two feet square; these foundations, as they were laid upon "made land" with a treacherous substratum of mud penetrated by the tides, required very exceptional care in their construction. We notice that the architect characterizes the style of the church as a free rendering of the French Romanesque of central France; and meets the objection so often made as to the subordination of nave and transepts to the central mass of the tower by referring to some characteristic features in the churches of Auvergne, in which, as he says, "the central tower, a reminiscence perhaps of the domes of Venice and Constantinople, was fully developed, so that in many cases the tower became, as it were, the church, and the composition took the outline of a pyramid, the apse, transepts, nave, and chapels forming only the base to the obelisk of the tower." Accepting this as a solution of the problem, he considers himself justified in making his tower central and the principal object in all his façades. Mr. Richardson does not formally acknowledge his indebtedness for the *motif* of the tower in general aspect and details (especially in the earlier studies of it) to the lantern or *cimborio* of the old cathedral of Salamanca, which is so much admired by Street, and which is essentially Spanish in its character. The original design, as we remember it, had more of the Auvergnat character, in the low square tower surmounted by a slender octagon lantern, as at Issoire, Brioude, Clermont Ferrand, Riom, and other churches of the district; all of which by the by, had, we believe, naves of from five to seven bays, — an offset to the height of the tower, the absence of which in the Boston example we cannot help regretting. In these churches somewhat of the pyramidal effect to which Mr. Richardson refers can be seen from all points of view, except those which comprehend the length of the nave. But we recognize of course that the exigencies of Protestant worship require rather the compactness of an auditorium than the "stretched metre" of a processional nave; and we can hardly blame the architects that they have faced the grave difficulty so frankly, more especially as, in doing so, they have given us in the tower a composition so manly and refined, so vigorous and so well studied in execution, that it is well worthy of its pre-eminence in the design both within and without.

WE are glad to state that a meeting of the Trustees of the American Institute of Architects has been called for the 16th inst., to consider the question of the Washington Monument. The Institute, representing as it does the entire profession in this country, can hardly afford to remain silent in such an emergency; and its advice, if offered, cannot fail to be received with consideration and respect.

WE fear it cannot be denied that the new school of architecture which has arisen here and in England since the mediæval revival has in great part lost that sensitiveness to harmony of proportion and to refinement of detail, that studied elegance and purity of line, which distinguished the best works of the Renaissance, and which still admirably prevail, unsubdued by fashion, in the practice of the *École des Beaux-Arts*. As regards the effect upon the student, the substitution of the height of a man for the diameter of the column as a unit of proportion has brought with it consequences of the greatest importance, and is in many respects to be regretted. In the beginning, the practice of the picturesque, the quaint, the archæological, cannot take the place of the practice of precision and order without begetting just that looseness of habit in design and that imperception of symmetry and balance of parts which characterize the minor works of modern architecture, as illustrated not only in our own pages, but in those of the English *Builder*, the *Building News*, and the *Architect*. The education which causes the young architect to impress upon his works the idea of novelty and variety, rather than of correctness and simplicity, which encourages his imagination rather than purifies and chastens it, can scarcely be a wholesome discipline. For these reasons we think it may be stated with confidence that a form or style which has become academic, and, by the accumulation of thought which has been bestowed upon it by successive generations of artists, has crystallized into types, standards or orders, is better fitted for the training of the architectural student than one which has been given to us by the archæologists, which is not hedged about by artistic traditions, and, for its proper expression, is not dependent upon the fine mutual relations and exact adjustments of its minutest parts. A student who has not been trained to a condition of fastidiousness or sensitiveness in regard to the outline of a moulding cannot compose in any style without betraying sooner or later a want of feeling or an illiterateness which is fatal to good architecture. It is as true in art as in morals that one must be faithful over a few things before he can be ruler over many. The classic orders may thus be considered the primer of design; if they are not mastered in the beginning by the student, he can hardly express his thought grammatically even in mediæval language. It is true that Edwin von Steinbach, Robert de Luzarches, William of Wyckham, were great architects in their day, although they knew nothing of the Doric or Ionic orders; but they were great *notwithstanding*, not *because of* this ignorance. The conditions under which they designed are not the conditions under which we design; the modern ideal cannot exclude the consideration of any of the precedents of style which are available in the books. It has been remarked that the graduates of the *École des Beaux-Arts* who have come to this country to practise, so far from being cramped in their methods by the classic limitations of their studies, adapt themselves to their new circumstances, and express themselves in any architectural language, whether classic or Gothic, brick or stone, or even in our own wooden vernacular, with a facility, freedom, and correctness, a grace and an elegance, beyond the reach of any who have not enjoyed similar advantages. The curriculum of such architectural schools as that of the Massachusetts Institute of Technology already promises results at least equally good. Let us hope that they will leaven the lump.

IN the midst of the freedom (shall we not say license?) which has been engendered in modern work by our mediæval habits of design, the reproduction of the brilliant sketch of Döllinger, in the present number, may perhaps be accepted as a matter of refreshment, if not of instruction, especially as the subject of the sketch is a purely academical composition, executed with the greatest spirit consistent with the precision and correctness of classic form. It is far from our intentions to renew in any way the barren battle of the styles; but we believe the most uncompromising of the modern mediævalists cannot but be filled and revived by a piece of work so elegant and masterly as this Neapolitan arch. *Fas est et ab hoste doceri.* We may be permitted therefore to

ask our younger professional readers to note in especial, the harmonious proportional relations in the heights of the four successive stories in this design, no two heights being alike; and, for the enforcement of the contrast, the two narrower stories or divisions alternating with the two wider. Observe also the ingenuity with which the important incident of the sculptured procession of triumph, instead of having a mere frieze enlarged to receive it, has an order to itself, with its own frieze so decorated as not to compete with it. Note also the elegant device by which the triumph moves quite across the monument without interrupting the breaking of the order over the coupled columns; and how the triumphal car, instead of being placed directly on the centre, as an inferior hand would have disposed it, moves *toward* the centre so as to give the impression of movement. Moreover the multiplication of horizontal mouldings across the die of the pedestals under the principal order, and the great spread of the mouldings of the base, are infringements of the fixed formulas of the order, for the sake of an expression of force needed at this point. Again, in the general disposition of sculpture there seems to be an intention in each successive story, to represent a higher thought than in the one below; thus the earthly dignities, as set forth in the armorial bearings on the keystone with the supporters in the spandrels of the first stage, are less in their significance than the incident of the triumph which occupies the second. Then we may suppose under the arch of the third stage, with the Victories in the spandrels, the mounted hero in a great alto-relief, at last beyond the reach of praise, immortalized; and finally in the attic stage there are the personifications of the four cardinal virtues under which he triumphed. But what concerns us most to note is not so much the poetical element in this design as the elegance and freedom with which the architectural idea is set forth in the purely conventional forms of the Renaissance; and that these forms constitute, as it were, a polite language, which cannot be made available to any one without a careful training, which meanwhile educates the eye, refines the taste, gives sweetness and strength to the hand, and, in short, makes the artist.

MR. SHARPE'S PAPERS ON CHURCH ARCHITECTURE.[1]

THE reading of the latest number (the third) of Mr. Sharpe's Illustrated Papers on Church Architecture reminds us how much his profession has lost lately by the death of some of its leading writers. Mr. Sharpe's death was an especial loss in that it took him away from the midst of several investigations, or rather, perhaps, several branches of one investigation, of which he was gradually bringing forward the results in this series of papers. He was perhaps the first of living authorities — doubtless the first among Englishmen — on the architecture of the Cistercians, the great branch of the Benedictine order to whom most of the abbey churches of England were due, and the peculiar characteristics of whose building were at least coincident with, if not the causes of, some of the distinctive forms of English church architecture. At the time of his death he was still occupied with this subject, and with the closely related one of the transitional period; and it was, as our readers will remember, while collecting materials for this study among the churches of northern Italy that he caught his fatal illness.

An acute observer, clear and careful in his conclusions, with a mind full of the detail of his study, he had made studies of great value, but had never, so far as we know, collected the results of his work in any continuous statement, though the several detached essays which he published were gradually accumulating into material which, if he had lived and had chosen, he might have combined and digested in a very valuable treatise on the architecture of his favorite period. This is what we, and no doubt others of his readers, had hoped he would ultimately do; and the impossibility of it now is a cause of peculiar regret. The two earlier numbers of the Papers on Church Architecture were devoted to the special discussion of Cistercian architecture; with them may be counted other papers on the same subject before published, and in fact a great part of the matter of his large work, the Parallels. The last number, which is before us, is on the Ornamentation of the Transitional Period in Germany, and allies itself naturally with his treatise on the ornament of the same period in England. The whole series, it will be seen, covers but a short range in the history of architecture, and might, with other material which Mr. Sharpe is reputed to have accumulated, and what he could have added to it, have been wrought into a very valuable account of the development of monastic architecture into the completed Gothic of the thirteenth century. This is a work which has never been satisfactorily done, we believe, and which yet seems to us as interesting and historically as important as the study of any subsequent period.

The number before us contains twenty-one quarto plates on copper, from drawings made by Mr. Sharpe some forty years ago. They are drawn with the clearness, decision, and intelligent emphasis that characterize Mr. Sharpe's illustrations, and consist of plans, general views, and details of a number of interesting examples of the German architecture of the twelfth century; the date of that which he considers the latest being fixed at A.D. 1200. The expression "Transitional Period" is in its nature somewhat indefinite. Mr. Sharpe extends it over a wider range — at least in examples, for he does not fix many dates in this paper — than we were prepared to see. In some of his plates, in fact, there are few or none of the peculiarities which we are accustomed to ascribe to the transition. As he puts it, the transitional period in Germany ranges over the second half of the twelfth century to the very beginning of the thirteenth. Indeed, he adds: "There is reason to believe that throughout the whole of the first quarter of the thirteenth century, if not later, architectural art in Germany continued to be characterized by an ornamentation similar to that illustrated in the following pages, and by other features peculiar to the true Transitional Period."[1]

The paper does not pretend to be a treatise: it is simply a collection of examples with a brief commentary to each. The reader is often tempted to wish that the commentaries were fuller, — that less was taken for granted in the way of general knowledge, and more given of general illustration. What text there is, however, is like the drawings, clear and to the point. The last and presumably the earliest of the illustrations is the very curious and instructive little chapel of St. Walderic, at Murrhardt, a small building of a single vaulted bay and pyramidal roof placed diagonally, which is very suggestive of the upper story of a twelfth-century Rhenish tower set upon the ground, with an apse built against one of its faces. Round the apse a triangular arcade like those which belong to what the French call the *Style Latin*, as seen, for example, at Lorsch and St. Jean de Poitiers, is combined with the richest advanced twelfth-century ornamentation. The chapel of St. Eucharius at Nuremberg greatly resembles in style the better known and elegant little church of St. Andreas at Cologne, but is much earlier or at least ruder, both in mouldings and capitals. Its striking peculiarity in vaulting is worth notice. It is planned in two equal aisles of three bays, the vault of one aisle being round and the other pointed, while both are identical in detail and rest upon the same row of dividing columns; and there is no reason to suppose that they were not built together. The illustrations from Maulbronn, Heilbronn and Ebrach are quite in the range of Mr. Sharpe's other work, being all portions of Cistercian monasteries. The doors of the refectory at Heilbronn is a fine example, — a trefoiled door fitted with quaint awkwardness under a round arch. A queer discrepancy is to be noticed between the print given of it in Lübke's history, and Mr. Sharpe's. In Lübke's the moulding around the trefoiled door opening is finished at the bottom as a stop-chamfer; in Mr. Sharpe's it runs to the ground. In the first a prismatic shaft on the left is enriched through its whole height, in the second only in the half above the ring. The Byzantine ornament in the irregular tympanum between the round arch and the door-head is very differently treated. Both are equally clear and positive, and the differences are a good example of the difficulties in evidence with which the architectural student too

[1] Illustrated Papers on Church Architecture. By Edmund Sharpe, M.A., F.R.I.B.A. No. III. November, 1876. The Ornamentation of the Transitional Period in Germany. London and New York: E. & F. N. Spon

[1] We ought to explain that the text actually reads, "there is no reason to believe." As the reader will see, however, it is impossible to believe that the word "no" is any thing but a clerical error. Mr. Sharpe mentions the noteworthy statement of De Lassaulx that the same archbishop in the same year, 1248, dedicated at Cologne the transitional church of St. Cunibert, and laid the foundation-stone of the cathedral.

often has to contend. The large-scale detail given by Mr. Sharpe seems to show that he is in the right, and suggests that in this case the German draughtsman probably "cooked" his detail a little when away from the original.

At another point, however, we find Mr. Sharpe tripping; for the text says of his first example that "the whole chapel was vaulted with simple quadripartite vaults," while in the plates the plan indicates that the vaulting of the westernmost bay of the nave is hexapartite, while the interior view shows two hexapartite bays out of three. This chapel of St. Michael, in the Cistercian abbey church at Ebrach, is the latest and the most fully illustrated of Mr. Sharpe's examples, — a charming little cruciform chapel, a miniature in form and proportion of plan of the church to which it is attached, which had already been illustrated in the second paper of the series. It contains in small compass all the most characteristic features of German transitional architecture; trefoiled wall arcades with quatrefoils sunk in the spandrels, cinctured columns, piers of clustered shafts, corbelled vaulting shafts, those of the diagonals with their square abaci set across the angle, a pointed vault, mixed in form as we have described, and ribs moulded with stop-chamfers. There are swelled shafts and capitals of all types from the complex German sculpture of the twelfth century to the French crocket capitals of the thirteenth, and even fair specimens of the Early English banded capital, but with a square abacus; and this while the mouldings are remarkably uniform throughout and apparently all transitional. The whole has the fine combination of lightness and solidity, of richness and animation with breadth and without restlessness, that distinguish the best transitional work of middle Europe, and of which the church at Gelnhaussen is perhaps the most brilliant example.

In the preface to this number Mr. Sharpe promised to follow it by others devoted to the transitional period in the north and west of France. It was said at the time of his death that a part of this promised material was nearly ready for publication: we sincerely hope that some means will be found of giving it to the world.

THE SET OF CEMENTS AND MORTARS.

BY a curious misuse of terms, one of the earlier writers on cements, quoting Dr. Higgins, whose work was published in 1780, divides all the lime compounds into two classes, — "*calcareous*, or those which are used for works exposed to the air, and *hydraulic*, or such as are used under water." Now, we must include all building cements under the first of these terms, for "calcareous" simply means partaking of the nature of lime. But the second term has long been very properly applied to such calcareous cements only as possess the power of induration under water. Vicat, a French writer, proposed a much better subdivision of limes into classes. His terms were as follows: 1, Fat; 2, Lean; 3, Moderately hydraulic; 4, Hydraulic; and 5, Eminently hydraulic limes. In the present day we employ the terms fat and poor limes, hydraulic limes, and cements, which seems a very fair and natural classification. Leaving out of the question altogether the compounds of magnesia and similar non-calcareous cements, and that class of cements of which sulphate of lime, or gypsum, is the basis, we propose to glance at the so-called set, and the induration of the commoner limes and cements, and, in the course of our observations, to deal with the use of those agents usually employed to promote the hydraulicity of mortars.

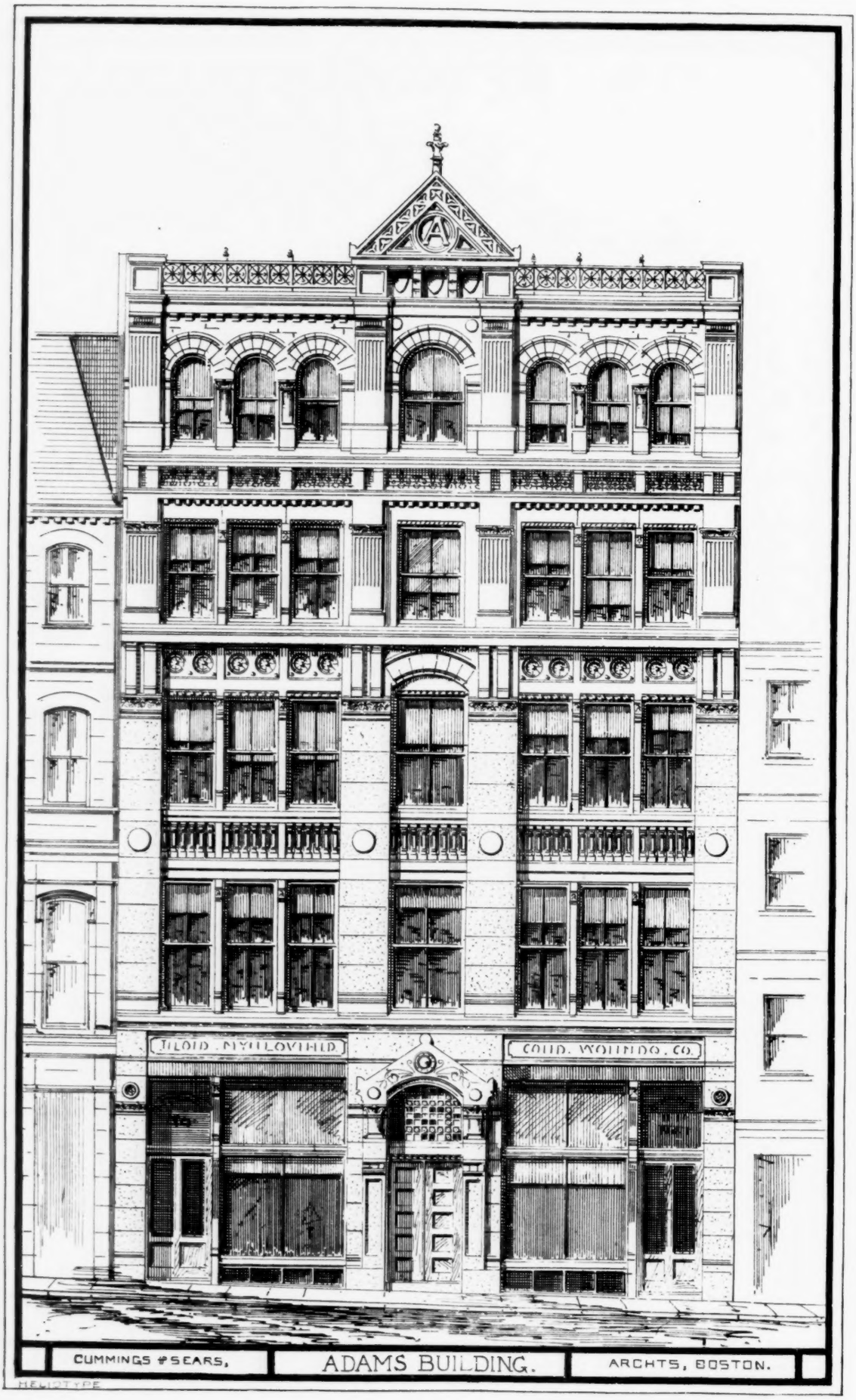
In the process of burning chalk or limestone, as it is well known, the carbonic acid gas is more or less completely expelled, and the lime used by the builder is quick or caustic lime, the oxide of the metal calcium; the cements we use being chemically impure silicates of the oxide of calcium. The pure or fat limes are those which consist of pure oxide of calcium; the poor or lean limes contain varying proportions of silica, iron, and alumina. Such limes as contain considerable quantities of silica only are quite unfitted for the builder. The fat limes are the easiest to burn, as they simply require steady and long-continued heat, while limes containing clay and ferruginous matters are liable to fuse, or run into a clinker in the kiln. At a less degree of heat, they readily blue, or turn of a bad color; and some impure limestones splinter or shatter into pieces in the kilns, and spoil the draught, unless the heat is very gradually applied. The natural cement stones, such as those of Harwich and Sheppey, are the nodules of argillaceous limestone which exist in many clay strata. The nodules of the London clay burn into an excellent Roman cement, and cements of this class are fired at a very low temperature. Portland cement is a mixture of lime and clay artificially compounded and burned to incipient vitrification. We have in this country many clay shales and limestones which contain naturally the proper proportion of lime and clay to form Portland; but, so far as we know, they have never yet been utilized for the preparation of cement. At Rugby, however, the lias shale is ground up with small quantities of lias limestone, and manufactured into Rugby Portland cement. Some of the Medway cement-makers also employ the gray or soap-lime with smaller proportion of clay in lieu of the white chalk-lime and clay formerly in sole use for Portland making.

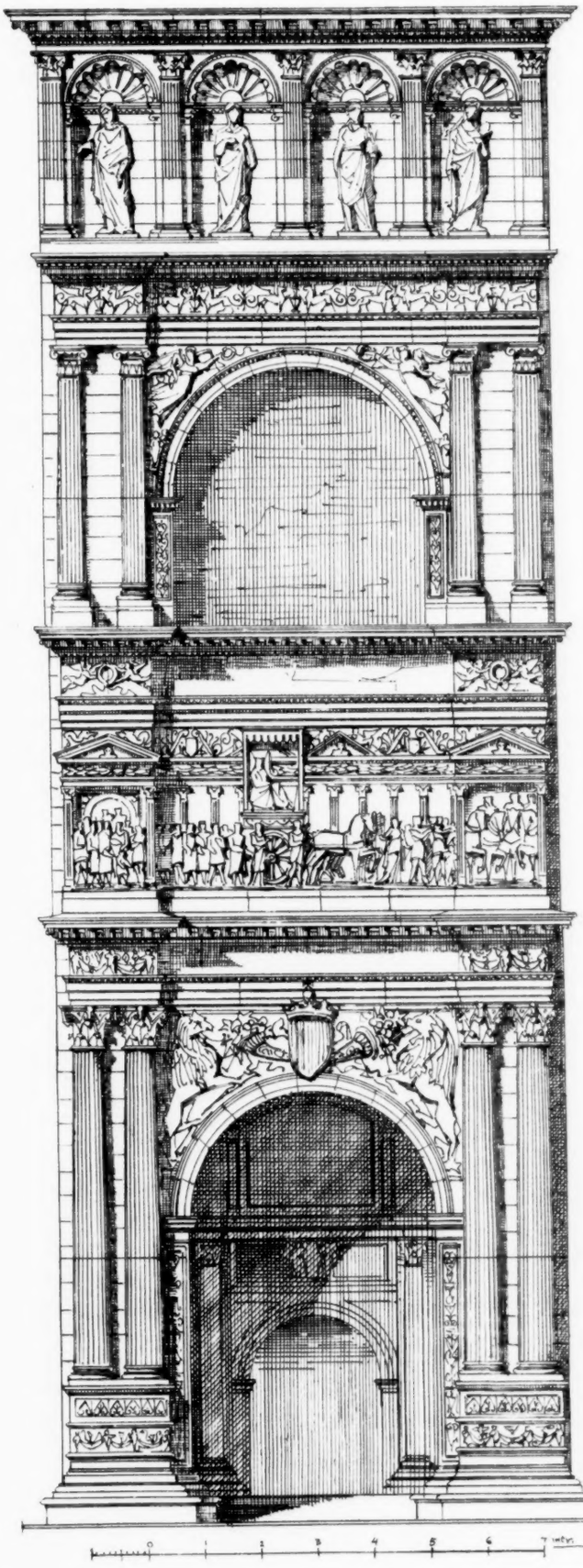
The induration of pure limes is much better understood than that of compounds of lime, silica, and alumina. Lime made from white chalk or mountain limestone, when properly slaked, goes abroad into a bulky powder, chemically termed hydrate of lime. The particles of this powder are extremely minute. Slaked lime is, in fact, one of the finest powders in nature; one hundred parts of chalk are reduced by burning to fifty-six parts. The quicklime thus obtained absorbs on hydration, or slaking, eighteen parts of water, which it solidifies. This slaked lime forms, if mixed with an excess of water, a pasty mass, which dries into a friable powder of hydrate of lime. If the quantity of water is barely sufficient for the slaking of the lime, we obtain, in lieu of the very fine powder, a granular coarse hydrate, — a crystalline hydrate, in fact, — and the lime is said to have been "chilled." Slaked lime — except when employed as putty or for white-washing — is always used by the builder, in combination with sand, to form mortar. When properly amalgamated, this mixture of lime acquires, in from twenty minutes to half an hour after it has been employed for the purpose of the bricklayer, a certain amount of consistency, or a species of pseudo-set. This is the first set: the real set, or induration, takes place in the case of pure lime mortars, after a long interval of time, and then only at the surface, working gradually inwards. The first set is, we believe, mainly due to the absorption of the water in the mortar by the porous brick or stone, and it has nothing to do with the real induration. The genuine set is partly due to re-conversion of the hydrate of lime into the carbonate of lime, by the carbonic acid of the atmosphere, and partly to the formation of silicates of lime, in the wet way, by a combination of the hydrate with soluble silicates present in the sand. It has been supposed that lime has the power of very slowly acting upon silica, when intimately mixed with it in the presence of moisture. It will be understood from this that it is of the utmost importance to insure a very complete and thorough admixture between the slaked lime and silicious sand; indeed, the nature of the set very greatly depends on the perfection of the tempering of the mortar. We read in all the old works on building, of the "beating" of the mortar; and formerly great attention was paid to this. It was thought a fair day's work for a laborer in 1750 to beat up twenty-five bushels of lime and thirty-six bushels of sand into mortar. By this beating, the particles of lime and sand were forced into very intimate admixture, and a first-rate mortar was produced.

The size of the grains of sand, and their shape, have also a very notable influence upon the quality of the mortar. A large-grained sand is invariably found to produce a better mortar than a small-grained sand. It is of advantage that there should be a considerable inequality in the relative sizes of the particles of sand. Water-worn sand is unfitted for mortar-making: the sharper the sand, the better. The object of adding the sand to the slaked lime is to provide proper points of attachment for the particles, and numberless interstices for the air to enter; and in tempering the mortar, we must take care that each grain of sand is entirely coated with the lime. Fine sand requires relatively a much larger proportion of lime than coarse sand, simply because the superficial area to be covered in the former case is much greater than in the latter. It has been sometimes asserted that if we measure the voids in any sand, we can arrive at the volume of lime which will be required for the preparation of mortar; but this is, we believe, an improper mode of estimation, as by this test, the larger the grains of sand, the greater would be the relative proportion of lime which a sand would need, while the finest-grained sand would want the least lime, instead of the most. Many authors have experimented upon various kinds of sand, and the evidence upon the subject is somewhat contradictory; but from our own experience, we incline to the theory we have first stated. The influence of pressure or compression upon the set of lime and cement-mortar is remarkable; and the reasons for this will be evident to those who have followed us in these observations: for, under great pressure, we obtain a very perfect and intimate junction between the sand grains, the lime, and the materials cemented together. We know of no tabulated set of results showing the exact effect of pressure upon the set of a series of mortars as contrasted with the set of similar mixtures not subjected to pressure; but experiments of this kind would be of great interest, and we commend the inquiry to the attention of our readers.

Thus far we have occupied ourselves mainly with the set of limes and lime mortars of the ordinary kind. We will now pass on to a brief investigation of the set of cements and cement mortars. There are many limes of the kind termed in some of our former articles on kindred subjects "intermediate limes," which, when dipped in water and withdrawn several times, do not rapidly, or even after the lapse of some considerable time, heat and burst into a fine powder. Instead of behaving as other limes, they perhaps fall to pieces after a while, and either crumble gradually to dust, or such pieces may eventually become hard. If in the latter case we weigh a sample of the burnt stone before it is dipped in water,

·HOODED·MANTEL·FOR·HENRY·I·SHELDON·ESQ·CHICAGO·
·JOSEPH·T·CLARKE··2/VIII··77·
·DESIGNED·AND·EXECVTED·IN·OAK·BY·THE·HOVSEHOLD·ART·CO·BOSTON·


CUMMINGS & SEARS,
ADAMS BUILDING.
ARCHTS, BOSTON.



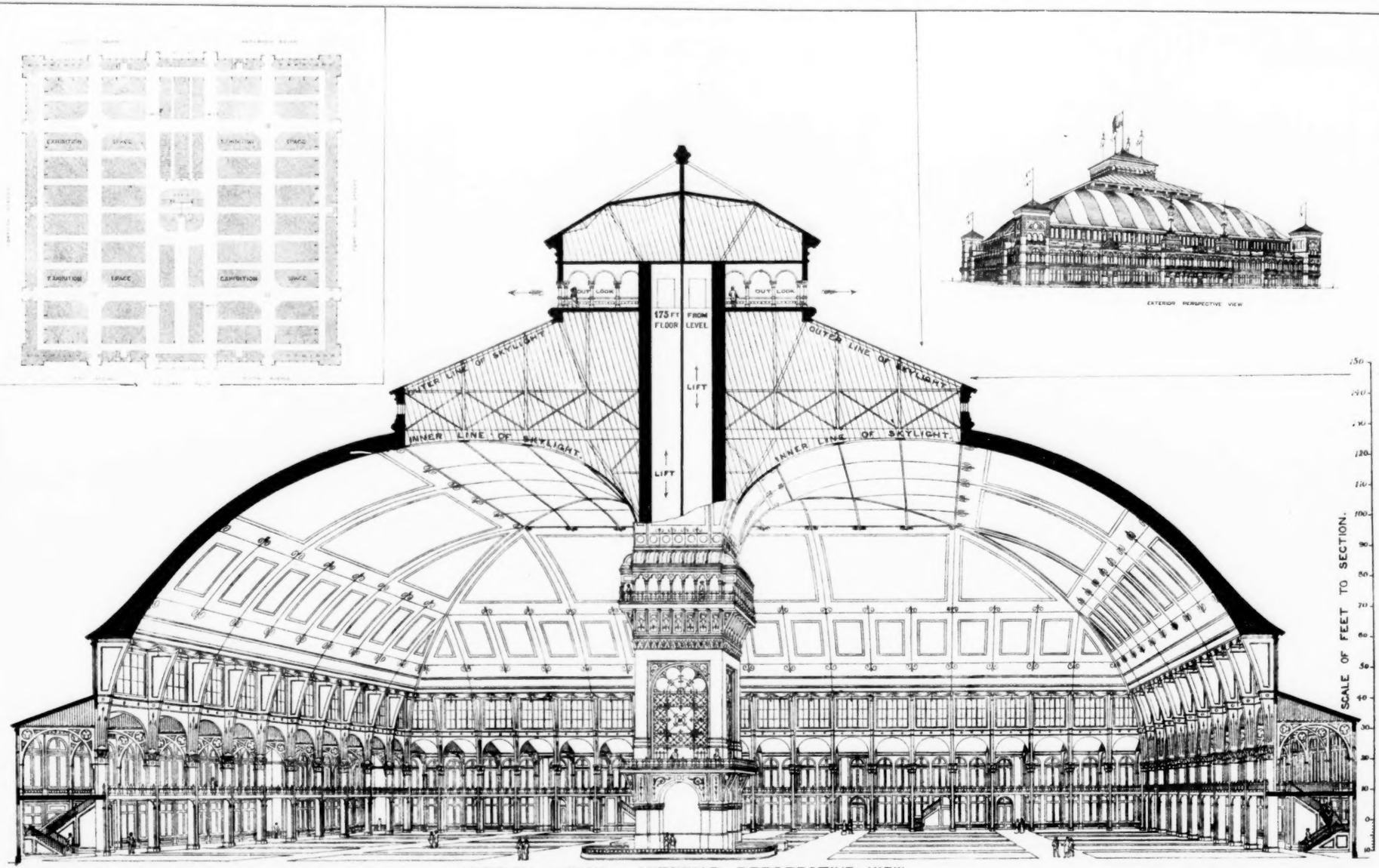
ARCH OF TRIUMPH
IN THE NEWCASTLE
AT NAPLES.

ERECTED 1470. A.D.
GIULIANO DA MAINO.
ARCHT.

AFTER A SKETCH
BY C. DOLLINGER.
ARCHITECT
STUTTGART.

HELIOTYPE

HELIOTYPE



SECTION — WITH — INTERIOR PERSPECTIVE VIEW

METROPOLITAN MUSEUM OF SCIENTIFIC INDUSTRY ——— AS PROPOSED FOR ERECTION ON THE SITE OF THE PRESENT RESERVOIR AT 42ND STREET ——— VAUX AND RADFORD, ARCHITECTS.

HELIOTYPE

and then, after it has been allowed to remain for some weeks in its shattered state, we collect and carefully dry at 212° all the broken fragments, we shall find that the lime has gained in weight, not perhaps quite as much as pure lime would have done (viz., the third of its weight when newly burnt), but still some considerable amount. Our lime sample has, in fact, solidified its water of hydration, and that without passing into the bulky powdered condition of the ordinary hydrate; and it is thus a true cement, this being the mode of discriminating between a lime and a cement. An intermediate lime (a term proposed by the French writer Vicat) is therefore a lime which behaves partly as a lime, and partly as a cement. If we still continue the examination of the sample we have just had under notice, and in lieu of dipping the lump into water, we in the first instance reduce it to powder mechanically, we have a specimen of the ordinary cement of commerce.

Cements may, for facility of reference, be divided into two classes, — quick-setting cements and slow-setting cements. These classes might be much subdivided; but for our present purpose the classification is sufficient. Quick-setting cements are relatively lighter in weight, darker in color, and richer in silica, iron, and alumina, than the slow-setting cements. We may take a Roman cement as a type of the former class, while Portland is the ideal cement of the latter class. Roman cement may either, as we have seen, be prepared from natural cement stones, or be obtained by the mixture of clay and lime in certain proportions. The characteristic of the cement is its inability to carry much sand, its adhesiveness to the materials to be cemented together, and its tendency to spoil rapidly when exposed to the atmosphere. Portland cement, the type of the other class, is exactly the opposite to it in each of these features. Roman cement is ruined by more than two parts of sand. It works so fat and rich under the trowel, that the plasterer delights to use it; and we cannot keep it open for more than a week or two without having it utterly spoiled. The set of Roman cement is due to the formation of a compound silicate of lime, iron, and alumina. In the darker cements, the iron is always in considerable excess. It is not absolutely necessary that a quick-setting cement should be dark in color (some are very pale); but we generally find a large quantity of iron in them, to which they owe their color. We cannot give very satisfactory reasons why the quick-setting cements carry so little sand. It may be caused by the imperfect nature of the silicates which exist in them only in a state fit to be called into activity by means of moisture, and incapable of being formed when diluted with sand. Portland cement requires to be burnt at a very much higher temperature than a cement of the quick-setting type. The heat of a Portland kiln would fuse the Roman cement into a black glass. We have in former articles described the preparation and set of this cement, and we need do no more now than state that its excellence is chiefly due to its great density, to its power of remaining unchanged for a considerable time exposed to the air, and to the readiness with which it will carry large proportions of sand. The silicates of the Portland type are very different from those of the Roman cement type. They are mainly formed by heat, and on coming into contact with water, they combine chemically with it to form hydrated silicates. The Roman cement compounds are probably more of the nature of silicates formed in the wet way by lime, iron, and alumina, in the presence of silica and moisture. If we burn a Roman cement to the point of partial vitrification, we obtain a slag which, on being ground to powder, shows no tendency to combine with water. The silicates have, in that case, been already formed by heat, and being insoluble, the resultant powder is useless for the builder's purpose. The chemistry of these cements has been much more carefully studied by German chemists than by our own countrymen; and the theories we have just advanced must be taken more as suggestions than as actual facts.

M. Schott, who has devoted very great attention to the curious and novel cement action of lime in the presence of minute quantities of sulphuric acid, which has been discovered by his English namesake Gen. Scott, and by him termed "selenitic action," has made known some very remarkable properties which are exerted by quicklime under certain conditions. He says that if we mechanically reduce quicklime to powder, and ram this powder into a strong metal cylinder, closed when full with a screw cover, and perforated all over with very minute holes, and then, by placing the cylinder in a vessel, allow water to enter slowly, we effect the hydration of the lime much after the manner of a cement, and we obtain a cake of dense hydrate of lime entirely different to the bulky powder which is produced under ordinary circumstances. He likens the material thus obtained to Gen. Scott's selenitic cement, which chemically is a hydrate of lime formed without much heat, and without the ordinary slaking action. We have not yet seen any explanation of the selenitic action which quite accounts for all the phenomena; and we have in a previous article stated what Gen. Scott's own theory is in regard to the set of his cement. — *The Building News.*

CHAPEL OF THE PALACE OF VERSAILLES. — Important restorations are going on at the chapel of the palace of Versailles, in the form of replacing and repairing the sculptures and other decorations of the building.

THE ILLUSTRATIONS.

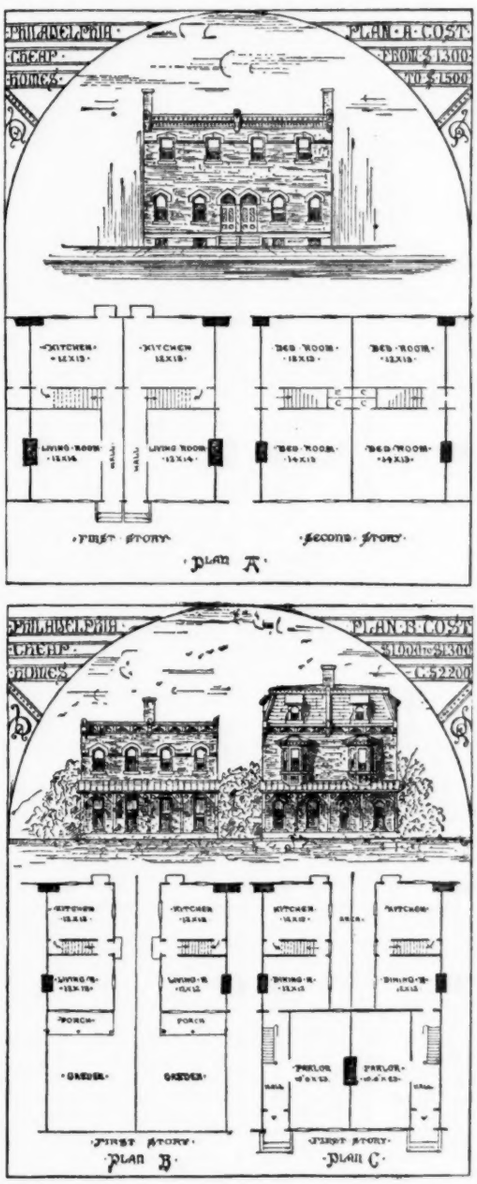
THE ADAMS BUILDING. MESSRS. CUMMINGS AND SEARS, ARCHITECTS.

(9 Pemberton Square, Boston, Mass.)

THIS is a building intended to be occupied chiefly by lawyers. Having a depth of 160 feet and a frontage on Franklin Avenue of 70 feet, it affords space for some forty offices, of various sizes, but all convenient, well lighted, and easy of access. An elevator runs from the second floor to the top of the building, and a fuel-lift from the cellar to the top. The Court-street front, of which a drawing is here given, is forty-one feet wide, and of Amherst stone.

PHILADELPHIA CHEAP HOMES.

These sketches, which first appeared in *Scribner's Monthly* for February, 1876, are referred to in our Summary.



PROPOSED METROPOLITAN MUSEUM OF SCIENTIFIC INDUSTRY, NEW YORK, N.Y.

As explaining the illustration of this proposed industrial museum which our New York correspondent has mentioned more than once, we print the letter addressed by the architects to the Mayor of New York.

SMITH ELY, ESQ., MAYOR OF THE CITY OF NEW YORK.

Sir, — To engage in successful competition with other nations in the industrial arts, it is requisite nowadays that the hand of the artisan should be guided by the light of science, and it is evidently desirable that he should be enabled at a metropolitan centre to study the best examples of what others have done and are doing.

At present there is no permanent educational institution of a polytechnic character in this country, except so far as the exhibition just commenced at Philadelphia may be considered as such; but it is probable that the time will shortly come, in the city of New York, for an active movement in this direction, and it seems clear that whenever a museum for such purposes is wisely organized here, it will be as much the duty of the State to aid in its establishment as in that of a museum of art or natural history.

It appears to us that the proposed abandonment of the Distributing Reservoir on Forty-second Street, and the consequent possession of a very eligible site, offers to the city of New York the opportunity for taking an important initial step towards the realization of this idea, entirely distinct from any present purpose of erecting a building; and we desire to lay before you, as chief officer of the city, a practical suggestion for the utilization of the ground, so that, if considered advisable, steps may be taken to secure it for the establishment of a Metropolitan Museum of Scientific Industry.

As will be seen by an inspection of the drawings now submitted, we show the feasibility of erecting at a proper time a building covering the entire area of the present reservoir, and consisting of, first, a hall or pavilion, 390 feet square, covered by an arched roof of 135 feet high from floor to ceiling, resting on outer walls, and converging to a central shaft or column; second, a corridor, with gallery over, surrounding the hall. The total floor space thus given will be about five and a half acres. The central shaft will contain stairs and lifts, giving access interiorily to a balcony under the ceiling, and exteriorly to a covered platform 175 feet from the level, which is intended as an outlook and open air refreshment-room.

Provision is made for an orchestra at the base of the vertical shaft, and a portion of the floor is furnished with seats for the audience.

Communication will be made with the park on the west side, with suitable approaches, etc.

By the mode of construction and arrangement proposed for lighting and ventilation, it is believed that the inconveniences arising from the glare and heat of the sun will be much less than is usually experienced in buildings erected for purposes of an analogous character.

Full provision for heating, and for the accommodation and convenience of visitors, has been made; and from the result of a careful estimate based on present prices, and assuming that the site is cleared to the level of Fifth Avenue, it appears that such a building could be erected in a substantial and complete manner for $850,000, exclusive of terraces and work on park approaches. We remain, sir, yours respectfully,

VAUX AND RADFORD, *Architects.*

THE TRIUMPHAL ARCH IN THE CASTEL NUOVO AT NAPLES.

(See Summary.)

This was erected in 1470, to commemorate the entry of Alphonso of Aragon (June 2, 1442), by Pietro di Martino, a Milanese architect, or, according to Vasari, by Giuliano da Maiano of Florence. The sculpture of the triumphal entry is by Isaia da Pisa and Silvestro dell'Aquila. In the frieze of the lower order is the inscription, "ALPHONSUS. REX. HISPANUS. SICULUS. ITALICUS. PIUS. CLEMENS. INVICTUS." In the frieze over the Triumph is the inscription, "ALPHONSUS. REGUM. PRINCEPS. HANC. CONDIDIT. ARCEM." In the attic are the four cardinal virtues. The archway covers the curtain wall between two vast round mediæval bastions.

HOODED MANTEL IN THE HOUSE OF MR. H. I. SHELDON, CHICAGO, ILL.

It should be said in explanation of the drawing, that the opening above the mantel-shelf is a window.

COMMUNISM IN HOT-AIR.

IN the course of a few years, a cross-section taken through one of the principal thoroughfares of one of our cities may reveal a curious condition of things below ground, which may at some future time furnish food for discussion to the antiquaries and archæologists of the races that are to succeed us. Already are the sewers, which are now looked upon as the most important aids to a proper condition of hygiene in towns and cities, sufficiently interfered with by the systems of pipes, both gas and water, which have to be avoided. Already is traffic so much impeded by the closing of streets while drains, sewers, gas and water mains, are undergoing repairs, that it seems to be not improbable that traffic may be at length driven from the streets altogether, and be carried on upon suspended viaducts, elevated railways, or roads upon the house-tops. Suppose that beneath the streets of one city should be placed all the different appliances which modern invention has contrived to meet the exigencies of rapid communication, of health, and of the comfort and convenience of home life. It would be a matter of the most serious study to so arrange these different systems that all might be readily reached for the purpose of repairs, and so that they might not interfere with one another. Thus, besides the sewers and gas and water mains which all cities now have, a city might have its foundations honeycombed by tunnels for underground railways, as at London; by tubes for pneumatic despatch, as at Berlin; by tubes containing telegraph-wires, as at Paris; by pneumatic tubes, which, as at Vienna, supply air to the pneumatic clocks; by pipes which furnish houses and factories with steam, as is being done at Lockport, N.Y., by Mr. Holly; by pipes which shall furnish houses and more particularly hospitals with fresh air, as is proposed by M. Autier, who has contrived a well-considered scheme, which there has been some talk of putting to a practical test in the great buildings of the International Exhibition of 1878, and if the system stands the test, it is to be permanently applied to the hospitals and public offices which are in that part of the city, and finally be so extended that any one may have fresh air "laid on" as well as gas or water. But besides being able to do away with privy-vaults, pumps, lamps, steam-generators, clock-cases, and open doors and windows, the modern householder may in the future do without furnaces, stoves, and open fires, if he so chooses; for Mr. William Bliss, of Springfield, Mass., after several years of patient study and perseverance, has obtained a patent upon a system by which hot air is to be furnished to consumers in any desired quantity and degree of heat from a central station. The practicability of the system depends mainly upon the fact that compressed air retains, and consequently can transmit, heat better than air under ordinary pressure, which by the process of heating has become rarefied. It also has this important property, that it can be moved in any desired direction, and is not, as is ordinary heated air, restricted to an upward motion.

Condensing pumps driven by steam or water power, situated near the heating-furnace, will force air through the furnace and thence through the mains. If the pumps are driven by steam, a saving is to be effected in the cost of generating the steam by placing the boiler on top of the furnace which heats the hot-air pipes, so that the heat in passing from the furnace to the chimney must pass through the flues of the boiler and so generate steam.

As it is likely that, in spite of all precautions that may be taken to prevent its loss, it will be impossible to deliver heat of sufficient power at distant places, or at certain places where an exceptional degree of heat is required, reheating-furnaces are to be established at different points upon the main line where it may be thought necessary. The mains and branch pipes which offer the best chance for the loss of heat are to be placed inside of concentric sheaths, the inter-space being filled with some non-conducting material.

Mr. Bliss does not propose to blow hot air into dwellings, but to cause it to circulate through pipes which shall heat rooms by radiation as is now done by steam-heating, over which system the new one will have manifest advantages; as, for instance, there will be no trouble caused by the water of condensation, which, besides the unpleasant noise it occasions in the pipes, is not unlikely to freeze and burst them, and at any rate entails a large outlay at the time of the installation in order to properly provide for its escape. It is also said that the cost of fuel for heating the air will be much less than for obtaining the same heating power from steam. Not only is hot air to be provided for heating dwellings, but also for cooking and for industrial purposes; for the system looks to providing hot air under such a pressure that fans and bellows may be dispensed with, and the consumption of fuel be materially diminished. This pressure will vary somewhat according to the points at which it is to be delivered, but will average about fifteen pounds to the square inch, while the degree of heat will average about six hundred degrees Fahrenheit.

THE FOUNDATIONS OF TRINITY CHURCH, BOSTON.

WE extract from the Description of the Church,[1] by Mr. H. H. Richardson, architect, the following passages relating to the foundations of the tower, and referred to in our Summary for this week.

"On testing the ground at the site a compact stratum was found, overlaid by a quantity of alluvium, upon which a mass of gravel, about thirty feet deep, had been filled in. Upon such a foundation was to be built a structure, the main feature of which consisted in a tower weighing nearly nineteen million pounds, and supported on four piers. The first pile was driven April 21, 1873. Every pile was watched, numbered, its place marked on a plan at a large scale, and a record made of the weight of the hammer with which it was driven, the distance that the pile sank at the last three blows, and the height from which the hammer fell. With these indications, a map of the bearing stratum was made, with contour lines showing the surface of the clay bed. . . .

"Under the centre of the church, a space ninety feet square had been reserved for the tower foundation; and this had been driven uniformly full of piles, as near together as practicable, over two thousand being contained within the area. This area, while the foundation walls for the other parts of the church were building, was subjected to various processes in preparation for its future duty.

"The piles within these limits were cut off at 'grade five,' six inches lower than the piles under the other portions of the building, as an excess of precaution against any failure of water for keeping the wood saturated. The ground was then excavated around the heads of the piles to a depth of two feet, and replaced with concrete. The concrete was mixed on the ground, put into barrows, and wheeled on plank ways laid on the heads of the piles to its destination, and thrown into the excavation. Four success-

[1] Consecration Services of Trinity Church, Boston, Feb. 9, 1877; with the Consecration Sermon by Rev. A. H. Vinton, D.D., an Historical Sermon by Rev. Phillips Brooks, and a Description of the Church Edifice by H. H. Richardson, Architect. Printed by Order of the Vestry.

ive layers, each six inches thick, were put in, and each thoroughly compacted with wooden rammers. The upper surface of the concrete was kept one inch below the heads of the piles, on the theory that the piles being the true support of the structure, it was important that every stone should rest firmly upon them, without coming in contact with the concrete, which might some time sink by the settlement of the gravel filling, and cause dislocation of any masonry which might rest partly upon it and partly on the unyielding piles. The concrete, however, had an important use in preventing the lateral motion of the piles, and to some extent connecting them together.

"Before the close of this season, the first course of one of the four pyramids which form the foundation of the tower piers had been laid on the piles; and as an experiment the outside joints were cemented up, and the whole then grouted with cement and sand till the joints and the space between the stone and concrete were flushed full. The pumping, which had been constantly kept up to free the excavation from the water which came in through the gravelly bottom, then ceased, and the water was allowed to enter the cavity, which it soon filled to the depth of about four feet, and the operations on the ground were suspended until the following spring. . . .

"On resuming operations in the spring of 1874, it was found that the tide water, coming in through the gravel, had affected the setting of the cement. The concrete was in a favorable condition; but the grouting of the masonry which had been started for the pier was still very soft, although made with a cement which under ordinary circumstances sets rapidly. In view of this unexplained difficulty, as well as the need of being able to proceed rapidly with the piers, without being obliged to wait for the setting of any doubtful cement, it was thought best to reduce the matter to certainty by using Portland cement throughout the piers. A variety of English and French Portland cements was tried, but the result seemed equally good with all, some difference in the rapidity of setting being the principal variation. The stones already set were taken up and relaid and with the substitution of the different cement, treated as before; the outer joints being packed close, and the inside grouted until completely full.

"At first the Portland cement was handled like Rosendale in similar circumstances, the cement being mixed rather dry, and after being put into the joints with trowels, compressed as much as possible with rammers; but further experience and careful trials showed equally good results by first filling the larger joints with a trowel and the dryer mortar, and then mixing some rather rich cement, sufficiently liquid to pour into the smaller joints from a bucket, stirring it well with the thicker portion until the whole was of a medium consistency, and had penetrated every interstice of the stone-work. Each course was levelled up to a uniform surface with cement and chips where necessary, before the next course was begun; and the upper bed of the third course from the top, and all the vertical and horizontal joints of the two upper courses, were taken out of wind and pointed, so as to form a perfectly close joint.

"Toward the close of 1874, the four pyramids of solid granite, each thirty-five feet square at the base, and seven feet square at the top, and seventeen feet high, were completed."

Upon these pyramids the four piers of the central tower were laid up with blocks of Westerly granite, each five feet by two and one-half and twenty inches high, with hammered vertical and horizontal joints set in cement, thus forming pillars five feet square.

CORRESPONDENCE.

STEAMSHIP WAREHOUSE. — CHURCH WORK.

NEW YORK.

IT is proposed to build a new freight-depot and landing-stage for outgoing and incoming cargoes at Pier 39, foot of Houston Street, North River. The work is to be done for the National Steamship Company; and in the arrangements for the receipt and delivery of freight the proposed building will certainly be unique, and promises to be a vast improvement over the methods now in vogue. The dock-buildings along the river-fronts of the metropolis would be worthy of a special article. Generally they are great sheds, built more with an eye to capacity and cheapness than to artistic appearance or substantial construction. With the wretched system of wooden piers and bulkheads for which the city is forced to pay annually enormous sums, it is not unnatural that flimsy wooden or sheet-iron structures should cover them; and the only wonder is that greater fires than those which do so frequently happen have not led to enormous losses of valuable freight stored temporarily in these dock-warehouses. In a few of the ferry-landings, particularly of the several ferries of the Union Ferry Company, some attempt has been made to secure presentable street and river fronts; but while these improvements are praiseworthy, there is a look of flimsiness and rusticity about the approaches which offends both the desire for honest construction and for the fitness of a building to its place and purpose. The French line of ocean steamships have also a long jointed freight-stage deserving of credit as something better than the ordinary run of rudely-built, angular pieces of clumsy carpentery which make a sail up and down either side of the island like a raid about the back yards of the city's rookeries. A liberal use of paint would do something to lighten up the dinginess; and a pruning process by the Dock Commissioners in compelling the demolition of many of the decayed structures which a vanished commerce has left fringing our city, would do much more to give New York a water-front to which her citizens might at least point with feelings other than shame.

The National Steamship Company's agent, Mr. Hurst, having determined upon the erection of a two storied freight-depot, was unfortunate at first in securing the services of an inexperienced designer to carry out his wishes. The pier is 580 x 75 feet over all; and allowing for gangway on either side, and the open space at the pier-head, the building proper was to be 555 x 71 feet. The pier substructure is new and the best of its kind. After several designs had been rejected by the dock engineers, Mr. A. B. Ogden, architect, and Albert F. Hill, civil engineer, were called in, and the present design prepared. The construction is to be of wood. The timbers of the sides rest upon a heavy wooden sill, and make a well-bolted pyramidal pillar 24 x 24 inches. The first story is 19 feet to the lower side of the upper floor-beams; the real working head-room is 16 feet, the remaining space being occupied by the chrome steel suspensory trusses, 27 in number, calculated for a load of 256 tons each, with a coefficient of 4. The clear span for these girders is 64 feet, and they are well secured by having the floor-beams strapped to them. They rest at the end upon curved bed-plates, allowing a slight motion or give, without which the structure would soon rack to pieces under the shock of colliding boats. The original designer proposed to support the upper story beams with 12-inch Georgia pine girders, strengthened by a 3-inch iron tie-rod, with a 3-foot depth at centre. What weight this construction would carry can be seen at a glance. The upper story of the shed is to be nine feet in the clear, the gravelled roof above supported on an ordinary Howe truss. The street-end of the building is of galvanized iron, measuring to the apex of the central pediment 52 feet. A 24-feet gateway will afford egress for the incoming freight, to the receipt of which the lower floor is to be entirely devoted. On either side of the gateway will be ports for the reception of foreign-bound freight. Upon being dumped from the truck, the cases, barrels, or parcels will be received upon an endless band, revolving over drums and rollers, and conveyed to the upper floor. Along the sides of the lower story great rolling doors will give access to the vessel's hatches, while the freight above will be delivered from strongly-constructed doors or shutters, which, when lowered, serve as delivering stages. The cost of the whole will reach nearly $80,000; and, should it answer the hopes of the owners, the other steamship companies may be expected soon to build similar buildings.

Mr. Arthur Crooks has just completed at Rosendale, N.Y., the Roman Catholic Church of St. Peter. It is 58 x 128 feet, with nave and clerestory in an arcade of windows. The interior finish is of wood, light and open, the aisle columns being eight inches square. To the apex of the roof the height is 52 feet. The exterior is of Colabaugh brick with Amherst stone finish and a sparing use of black brick; the windows are of stained glass. The whole interior is to be richly painted, and an altar-piece and reredos 32 feet long and 20 feet extreme height fairly blazes out in color. At the ends of the aisles are two chapels to St. Joseph and the Virgin Mary. On either side of the chancel are the priests' and boys' sacristies connected by a passage behind the reredos. Beside the church which seats 800, is a chapel 25 x 40 feet for minor celebrations. At the south-west corner of the front a tower and spire rise to 131 feet. The entrance is in the style of an open porch with timber-work resting on a brick base extending breast high. Near the church is a brick and stone residence for the clergy. The entire cost of the church, residence and all, was $30,000, which compared with recent prices is a marvel of cheapness. The church stands in a most picturesque site, and is well spoken of by competent critics who have visited it. Mr. Crooks has just completed drawings for the Church of St. Mary to be erected at Wappinger's Falls near Poughkeepsie, N.Y.

Among other architects matters are dull. Several of the city churches are undergoing changes during the dull out-of-town season; notably St. Nicholas Roman Catholic Church which is to have a new sacristy, and Grace Church which is to be extended by Renwick and Sands by carrying the chancel back. Mr. Robertson, of Potter and Robertson, is designing an organ-case for the same building. Mr. Potter is preparing the scheme of six lectures which he will deliver during the coming winter before the students of Union College. The two lectures given by him last spring at the same institution were so well received, that considerable interest is felt in the promised series, the first three of which will treat of art and architecture generally, the fourth will take up Greek and Egyptian architecture, the fifth Roman and Romanesque, and the last Gothic and Renaissance art. The historical lectures will be carefully and fully illustrated with views.

PERSIA AND THE PARIS EXHIBITION. — The Shah has sent architects to Paris, who are to construct a building upon the Trocadéro, for the Persian collections, which are to be of great interest and importance.

A SUBMERGED CITY.

THE Philadelphia *Press* quotes authority for the following story: Two divers who were seeking the valise of an American traveller that had sunk to the bottom of the Lake of Geneva, on the upsetting of a boat near the village of Saint Prex, not only recovered that article, but also found a superb Etruscan vase. Having reported that they found the bottom of the lake at that point broken and uneven, and that there were evident signs of ancient houses once inhabited by man, the municipal authorities of Saint Prex instituted an investigation. They covered the surface of the lake at the locality in question with oil, the effect of which is, as is well known, to render the water that it overspreads remarkably transparent. When the oil had extended over a considerable breadth of water, it was seen that the bottom of the lake was occupied by a town in a good state of preservation, the foundation of which goes back several centuries before the Christian era. Whole squares or islets of houses were discovered, their roofs covered with a thick coat of glutinous mud. Through their slimy envelope, the houses had the appearance of being constructed of brick, with the famous vermilion cement which the Celts, the Cimbri, and the early Gauls made use of, and which is harder than the Roman cement even. The Vaudois Cantonal Council is about to make an appropriation for the construction of a great jetty that shall surround the submarine city, and facilitate its being drained out and connected with the shore. Many interesting discoveries are expected when this ancient lacustrine town is thoroughly explored, and the contents of its houses are made accessible.

NOTES AND CLIPPINGS.

OBITUARY. — Martin E. Thompson, a well-known architect, died July 3, near Elizabeth, N.J. From 1835 to 1855 he was the foremost American architect, as before his time all the principal buildings were designed by foreigners. He built the old City Hall in New York City, the First Presbyterian Church (Dr. Paxton's) on Fifth Avenue and Twelfth Street, the Arsenal at Central Park, the State Prison at Sing Sing, in 1833; he changed the Middle Dutch Church into the old post-office, and the Deaf and Dumb Institute in Columbia College. He also built the Hanover and Tradesmen's Banks, and a large number of fine stores.

ACCIDENTS. — The side wall of a building in course of erection at No. 540 Pearl Street, New York, fell Aug. 4, and two laborers were slightly injured.

An accident occurred at the Lucy Furnace Company's Works, at Pittsburg, Penn., on the morning of Aug. 3, which resulted in the death of two men and the injury of five others. Seven men were engaged in lining a furnace, and were working on a scaffold which was supported by ropes. These took fire from the furnace, and the scaffold fell, precipitating the men into the furnace. Julius Harding and Michael Cusick were taken out dead, and the five others were so badly burned that they are not expected to recover.

In addition to the accidents mentioned above, the past week has been marked by two disasters quite as painful in their nature as those at Brooklyn and Ashtabula. On Friday, Aug. 3, a cigar factory was burned at Cincinnati, O., causing the death of six persons, — three girls who were in the fourth story ready to begin work, and three men in the third story. Luckily most of the hands had not arrived, or the loss of life would have been greater, and the criminality of the builder and owner in having provided only one narrow staircase for such a building would have been more apparent. The second disaster took place on Saturday, Aug. 4, near Simcoe, Ont., where seventeen inmates of the poorhouse upon the Industrial Farm of Norfolk County were burned to death.

ACCIDENT IN A QUARRY. — Early Saturday morning, July 28, before the workmen arrived, a large portion of the ceiling of the blue marble quarry at West Rutland, Vt., belonging to the Rutland Marble Company, fell in. The sound caused by the fall was heard for miles, and persons in the vicinity thought an earthquake had occurred. It is estimated that fully five hundred tons of rock fell.

BRICK-MOULDERS' STRIKE. — The brick-moulders of Memphis, Tenn., are on a strike, demanding an advance of twenty-five cents per day on the wages which have been paid for the last six years. The demand was refused, and work in all the brickyards is stopped, causing an advance of thirty cents on brick.

A LARGE STEAM PUMP. — Messrs. Cramp and Sons have now completed, with the exception of the boilers, the immense steam pumping engine which is intended for the Frankford Water Works, Philadelphia. The entire machinery will be ready to go into operation by the 1st of October. This engine was built at the contract price of $46,000, and has a pumping capacity of 10,000,000 gallons per day. It is a double-cylinder engine, the smaller cylinder being 40 inches and the other 60 inches in diameter. The pumps are 21 inches in diameter, and five feet stroke. The Frankford reservoir has a capacity of 36,000,000 gallons, to which have been run a 30-inch pumping-main and 20-inch distributing-main. There will be three boilers, two of which will furnish steam for 500 horse-power. The third boiler will be held in reserve for emergencies.

DISTEMPER COLOR FOR WALLS. — Looking at the matter of wall decoration from a sanitary point of view, the *Lancet* says that distemper color can be applied over papers of almost any kind, and is especially adapted to covering up the rich flock papers that so often poison and encumber dining-rooms.

BRITISH STONE ANCHORS. — The Charleston, S.C., *Journal of Commerce* says, "There lie in the Stono River, near Church Flat, four stone anchors, which are supposed to have been cast there when the British first landed on Carolina soil. These anchors are square, and weigh about five hundred and ninety pounds each. An iron is run through the stone and riveted at the bottom, and at the top are fastened iron rings for the purpose of making them fast to a vessel. On the stones are cut the coat-of-arms of Great Britain. They are separated from each other not more than twenty-five feet."

ARCHÆOLOGICAL DISCOVERIES. — A few days ago some men were engaged in ploughing the side of a road near a farm owned by Mr. Fuller, about seven miles south of the city of Rockford, Ill., when they ploughed up some human skeletons. Upon this farm there are no less than sixty-six Indian mounds, some circular and some long. They are so arranged together as to form what military men say was once a good fort, and in primitive times must have made a good fortification against all foes and hostile tribes. The bones found are evidently those of three different persons. There were six *femora* and six *scapulæ*. The skulls found denote broad, square, massive face; chin very prominent, teeth farther apart than usual to men of the present day, and were very broad, showing that the owners lived largely on meat. Near these bones no relics were found. On this same farm some years ago a very complete vase was found in good state of preservation, which is now in the possession of the Chicago Archæological Society. The Rockford Scientific Society intend to make further investigations on this farm.

THE UNIVERSITIES AND THE NON-CONFORMISTS. — The English Presbyterians propose to put up two churches at Oxford and Cambridge, to cost not less than £25,000. The Scotch churches are asked to help, on the ground that Scotch Presbyterian students are found in the two universities. There is also a suggestion of the erection of a Presbyterian college at Oxford.

HYGIEOPOLIS. — Dr. Richardson's City of Health at Courtland, near Worthing, will probably be begun in the autumn. The architect and the engineer are busily engaged on the plans; and the estimates will be shortly obtained for making the roads and parade, and for the pier and protected area for bathing.

SOCIAL SCIENCE CONGRESS. — The following questions are proposed for discussion at the coming congress at Aberdeen, Scotland: —

Health Department. — 1. What is the best mode of providing suitable accommodation for the laboring classes, and of utilizing open spaces in towns? 2. How can the sanitary condition of the population engaged in the coast-fisheries of Scotland and the United Kingdom be improved? 3. The present state of house accommodation in rural districts — can its evils be remedied?

Economy and Trade Department. — 1. What are the causes of the present general depression of trade all over the world? 2. What are the social effects of trade-unions, strikes, and lock-outs? 3. What are the results of the administration of the Poor Laws in Scotland as compared with those of other parts of the United Kingdom?

Art Department. — 1. What principles should govern the restoration of ancient buildings, or their preservation as memorials? 2. Is our modern system of art competition favorable or unfavorable to art progress? 3. How can art be best introduced into the houses of persons of limited income? Voluntary papers on other subjects may also be read.

ENGLAND AT THE PARIS EXHIBITION. — The House of Commons has voted an appropriation of £12,500 for the English exhibit at the Exhibition of 1878.

THE BOIS DE BOULOGNE, PARIS. — The Bois de Boulogne is to be enlarged by adding land between the entrance to the Bois and the fortifications of the city of Paris, at a cost of about $80,000.

SELF-APPRECIATION OF FRENCH ARTISTS. — The *Société Libre des Beaux-Arts* has with singular modesty issued as the subject of its prize essay the following: *Chercher depuis quelle époque l'art français est supérieur aux arts étrangers.*

SANITARY SCIENCE IN PARIS. — Paris is awakening to the necessity of more attention to sanitary science; and the Society of Public Medicine and Professional Hygiene, lately formed, is under the immediate direction and patronage of the most eminent men in all sorts of positions. The society is divided into six sections, which will study respectively all that relates to the influence of climate on health, epidemics, including police inspection and international hygiene, private hygiene, public hygiene, professional hygiene, and statistics.

THE ZODTCHY. — We stated some time ago that the Russian architectural journal, the *Zodtchy*, was to issue a supplement in French. This has been done, and the monthly number is now accompanied by a supplement of eight pages, which contains excerpts from the weekly numbers of all that is likely to be of interest to foreign subscribers.

A PORTUGUESE BRIDGE. — The new iron railway bridge over the river Douro near Porto crosses it with an arch of a single span which measures 160 mètres (520 feet) and has a rise of 42 mètres (136 feet 6 inches). It is crescent-shaped in form; that is, the extrados and the intrados, which are connected by struts in the form of St. Andrew's cross, are farthest apart at the crown.

A NUBIAN TEMPLE. — The Temple of Ypsambul, in Nubia, is cut out of a solid rock, and is of vast dimensions. In it are four colossal figures sixty-five feet high, twenty-five feet across the shoulders, with faces seven feet high, and ears about a yard long.